

Amendments to the Figures

Please replace Figure 3 with the enclosed replacement Figure 3 in which "pKR274-2" is now referred to as "pKR274".

REMARKS

Submitted herewith is a Petition to Correct Inventorship pursuant to 37 CFR §1.48(b). Such correction was necessitated due to the cancellation of claims to the non-elected invention. Charles Kolar and William Hitz are being deleted as co-inventors.

New claim 140 has been added with respect to by-products obtained from the processing of the claimed oil. Support for this claims can be found in the specification on pages 24 through line 13 on page 27. Thus, it is believed that no new matter has been added.

In the event that allowable subject matter is found, Applicants respectfully request rejoinder of withdrawn claims 21-25 and new claim 140 since they pertain to oil obtained from the claimed seeds and by-product(s) obtained from the processing of the claimed oil.

The specification was objected to because the specification referred to plasmid "pKR274" while Figure 3 depicted plasmid "pKR274-2". Submitted herewith is a replacement Figure 3 in which the plasmid is referred to as "pKR274". This reference is used in the specification and in the Examples. Thus, no new matter has been added.

The claim dependencies have been corrected so that the claims depend from elected claims. The withdrawn claims have also been amended to correct claim dependencies so as to preserve the right to rejoinder.

Claims 2-10, 13-15, 19-15 and 29-139 have been cancelled since they are drawn to a non-elected invention. Claims 1, 11, 12, 16-18, 26-28 and new claim 140 are now pending.

Claims 1, 11, 12, 16-18, and 26-28 were rejected under 35 USC§101 on the ground that they are directed to non-statutory subject matter. It is stated on page 3 of the Office Action that the "claimed inventions are directed to non-statutory subject matter encompassing untransformed plants and seeds which are products of nature."

It is respectfully submitted that this ground of rejection is rendered moot in view of the amendment of claim 1. However, Applicants observed that oilseed crops do not normally produce higher polyunsaturated fatty acids having twenty or more carbon atoms, such as DHA and EPA.

It is stated on page 1 of the specification at lines 34-35 that, at this time, the major sources of DHA are oils from fish and algae. EPA is found in marine food and is abundant in oily fish from the North Atlantic.

Submitted herewith is a copy of Sayanova et al., *Phytochemistry* 65(2004) 147-158 which concerns biosynthetic routes and the potential for synthesis of EPA in transgenic plants. It is stated on page 147, toward the bottom of column 2 bridging the top of column 1 on page 148 that while "most mammals have a capacity to synthesize C₂₀₊ PUFAs from the dietary intake of the precursor fatty acids LA and ALA, higher plants in general lack this metabolic pathway. . . ."

It is stated further on page 149, column 2, that at "present the only significant direct human dietary sources of EPA and DHA are cold water fish such as cod, tuna, and mackerel. . . .Some fungi, mosses and bacteria also synthesize significant amounts of EPA and DHA; however, higher plants (the major dietary source of fatty acids) rarely contain PUFAs with more than 18 carbon atoms. According to current opinion, n-3 PUFAs are synthesized by microscopic algae and plankton at the bottom of the marine food chain. They are then passed up the food chain (via consumption by omnivorous and subsequently carnivorous fish species), ultimately to humans. . . ."

Accordingly, withdrawal of the rejection of claims 1, 11, 12, 16-18 and 26-28 under 35 USC §101 is respectfully requested.

Before discussing the next ground of rejection, Applicants were invited, on page 5 of the Office Action, to indicate the line and page number defining "fatty acid" and "PUFA." A "PUFA" is a polyunsaturated fatty acid. This is indicated on page 1 of the specification at lines 29-30.

"Fatty acids" are defined/discussed in the specification, for example, on page 1 at lines 12-18 and further on page 10 at lines 15-23. Those skilled in the art know from the discussion on page 10 at lines 23-that fatty acids are basically long chain carboxylic acids that occur in lipids. They may be branched or unbranched and saturated or unsaturated.

Claims 1, 11, 12, 16-18 and 26-28 were rejected under 35 USC §112, first paragraph, on the ground that the specification does not enable "any oilseed plant that produces mature seeds in which the total fatty acid profile comprises up to 1-

60% of at least one of *any* polyunsaturated fatty acid having exemplified and non-exemplified chain length and carbon-carbon double bond pattern. . . .

The instant invention concerns oilseed **plants** and the claims as amended concern, specifically, transgenic oilseed crops.

Claim 1 recites a transgenic oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

The purpose of the instant invention is to genetically alter the genome of an oilseed plant to produce mature seeds having an altered oil profile, specifically, a profile in which the total seed fatty acid profile comprises at least 1.0% of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

As was stated above, native or wild-type oilseeds do not normally produce mature seeds having the recited oil profile, i.e., at least 1.0% of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds. Since higher plants, in general, lack the metabolic pathway necessary to synthesize a PUFA having at least twenty carbon atoms from the dietary intake of precursor fatty acids, LA and ALA, it is highly unlikely that this could be achieved via mutagenesis. (Sayanova et al., *supra*) It appears that the best route to enable higher plants to synthesize a PUFA having at least twenty carbon atoms from the dietary intake of precursor fatty acids, LA and ALA, is to use genetic engineering technology.

The examples set forth in the specification demonstrate the production of a transgenic oilseed plant, e.g., soybean, that has been transgenically altered to have the recited oil profile.

The claims now recite a transgenic oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

With respect to the comment on page 7 of the Office Action concerning page 340 of Voelker et al. (that was co-authored by Dr. Kinney, one of the co-inventors of the instant application), it is noted that section appearing on pages 340-341 relates to

medium-chain specific thioesterases (belonging to the *FATB* gene subfamily). The fact that intense research was needed to find biochemical evidence for reduced-length acyl chain production does not mean that this applies across the board to all oil pathway manipulation. The statement was made in connection with one aspect thereof, an aspect not particularly germane to altering the genome of an oilseed plant to produce mature seeds in which the total seed fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

The examples demonstrate the production of such a transgenic oilseed plant. The fact that some experimentation is warranted does not necessarily constitute undue experimentation.

Reliance upon Deluca et al., to suggest that oil pathway manipulation is difficult, appears to be misplaced. This not-so-recent review was published in 1993. Much progress has been made since then as is evidenced by the Robert mini-review discussed below.

Reliance upon Topfer (1995) is also misplaced since it concerns the development of crops containing new oils with medium-chain triglycerides and high oleate or high erucate content. This is not salient to the instant invention which is not concerned with oil profiles encompassing medium-chain triglycerides. Furthermore, it is noted that Topfer stated in column 1 on page 685 in the Conclusion and Prospects heading that the progress made thus far should encourage the development of new oils with medium-chain triglycerides and high oleate or high erucate content.

The fact that Robert minireview (2006) engaged in trial and error experimentation is not surprising.

The Examiner's attention is kindly invited to page 106, first column, section preceding the quote regarding soy, this section describes Dr. Kinney's work which constitutes the subject matter of the instant application. Specifically, Robert states that prior "to the study of Robert et al. [2005] due to the lag between patent submission and publication, Kinney et al. [2004] were **successful in producing high levels of LC-PUFA (19.6% EPA, 2% to 3.3% DHA; see Table 1) in soy (*Glycine max*) seed and embryos**. This group transferred multiple genes, predominantly from fungi, to achieve EPA synthesis in soybean seed and DHA synthesis in

regenerated soy embryos (see Table1). Most interesting was their use of a Δ -17 desaturase that was able to shunt the majority of biosynthesis in the omega-6 pathway over to EPA in the omega-3 pathway (see Figure 1). In this way desirable omega-3 production was increased at the expense of less desirable AA production and in spite of the lack of selectivity of the other desaturases and elongases used for omega-3 fatty acids as substrates (see Figure 1). Clearly, soy is also a much better vehicle for LC-PUFA production than flax or *Arabidopsis* for several reasons pertaining to substrate availability. (Domergue et al., 2005)." (Emphasis added.)

The Robert article (cited on page 8 of the Office Action) quite eloquently and succinctly describes the success achieved by Dr. Kinney et al.

Moreover, the paragraph immediately following the above-discussed quote, discusses the work of Wu et al. (2005) in transferring a large number of genes into rapeseed (*Brassica juncea*) and produced high levels of AA and EPA and low levels of DHA. **Using the same method as Kinney et al. (2004)**, Wu et al. (2005) used a delta-17 desaturase to shunt a large amount of AA into the n-3 pathway at EPA.

Thus, the Robert mini-review unequivocally demonstrates that one skilled in the art would find significant guidance to produce the claimed invention. Wu et al. were able to make transgenic rapeseed **using the same method as Kinney et al. (2004)**.

The other articles cited are equally inapposite for all of the reasons discussed above.

In view of the foregoing, it is respectfully submitted that one skilled in the art could make and use the claimed invention without engaging in undue experimentation.

Withdrawal of the rejection of claims 1, 11, 12, 16-18 and 26-28 under 35 USC §112, first paragraph, as not being enabled, is respectfully requested.

Claims 1, 11, 12, 16-18 and 26-28 were rejected under 35 USC §112, first paragraph, as failing to comply with the written description requirement. It is respectfully submitted that in view of the claim amendment and the above-discussion, especially with respect to the Robert article discussed *supra*, that the written description requirement is fully satisfied.

Accordingly, it is respectfully submitted that given the claims, as amended, and the abundance of guidance as evidenced by the Robert mini-review discussed

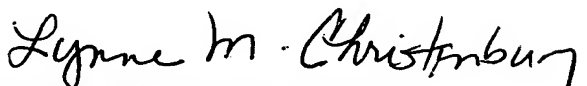
above, one of ordinary skill in the art would have recognized that Applicant was in possession of the claimed invention at the time of filing.

It is respectfully submitted that the claims are in form for allowance which allowance is respectfully requested.

A Petition to Correct Inventorship, a copy of Corrected Figure 3, a copy of Sayanova et al. form PTO/SB/08B accompany this response.

Please charge any fees or credit any overpayment of fees which are required in connection with the filing of this Response After Final to Deposit Account No. 04-1928 (E. I. du Pont de Nemours and Company).

Respectfully submitted,


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